

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9611Roll No.

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B.Tech.

(SEM II) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

ENGINEERING PHYSICS - II

Time : 2 Hours

Total Marks : 50

- Note :** (i) Attempt *all* questions.
 (ii) Marks of each question are shown against it.
 (iii) The physical constants are given at the end of the question paper.

SECTION - A**1.** Attempt *all* parts. All parts carry equal marks. Pick the correct choice from the following: (1×10=10)

- (a) The masses of neutron and electron are m_n and m_e respectively. If they have the same de Broglie wavelength, then their velocities should be in the ratio.

- (i) 1 : 1 (ii) $\frac{m_e}{m_n}$ (iii) $\frac{m_n}{m_e}$ (iv) $\frac{m_e^2}{m_n^2}$

- (b) The characteristics of wavefunction ψ are :

- (i) Real function, finite and discontinuous.
 (ii) Complex single valued, finite and continuous function.
 (iii) Complex infinite and discontinuous function.
 (iv) Complex single valued and infinite.

- (c) Compton shift is given by :

- (i) $\frac{h}{m_{oc}} (1 - \sin \phi)$ (ii) $\frac{h}{m_{oc}^2} (1 - \cos \phi)$

- (iii) $\frac{h}{m_{oc}} (1 - \cos \phi)$ (iv) None of these

- (d) Which of the following is not equal to the dielectric constant.

- (i) $\frac{V_0}{V}$ (ii) $\frac{C_0}{V}$ (iii) $\frac{E_0}{E}$ (iv) $\frac{\epsilon_0}{\epsilon}$

- (e) In an isotropic dielectric medium.
- D and E are perpendicular to each other
 - D and E are inclined at 45° to each other
 - D and E have the same direction
 - D and P are perpendicular to each other
- (f) Ferromagnetic substances have.
- High permeability and low susceptibility
 - Low permeability and high susceptibility
 - Both permeability and susceptibility low
 - Both permeability and susceptibility high
- (g) Which of the following equipments are used for the production of ultrasonic waves ?
- piezoelectric generator
 - magnetostriction oscillator
 - both (i) and (ii)
 - None of the above
- (h) The expression for displacement current density is.
- $J_d = \epsilon_0 \frac{\partial E}{\partial t}$
 - $J_d = \frac{1}{\epsilon_0} \frac{\partial E}{\partial t}$
 - $J_d = \frac{\partial E}{\partial t}$
 - $J_d = \frac{1}{4\pi\epsilon_0} \frac{\partial E}{\partial t}$
- (i) A super conducting material exhibits.
- Zero resistivity and complete diamagnetism
 - Zero conductivity and complete diamagnetism
 - Zero resistivity and complete paramagnetism
 - Infinite conductivity and complete paramagnetism
- (j) At nanoscale the surface to volume ratio is :
- very low
 - very high
 - equal to one
 - equal to five

SECTION - B

2. Attempt **any three** parts. All parts carry equal marks. (3x5=15)

- (a) Calculate the deBroglie wavelength of neutron of energy 12.8 MeV.
- (b) A nucleon is confined to a nucleus of diameter 5×10^{-14} m. Calculate minimum uncertainty in the momentum of the nucleon. Also calculate the minimum kinetic energy of the nucleon.
- (c) A particle is in motion along a line between $x=0$ and $x=a$ with zero potential energy. At points for which $x < 0$ and $x > a$, the potential energy is infinite. The wavefunction for the particle in n th state is given by :

$$\psi_n = A \sin \frac{n\pi x}{a}$$

Find the expression for the normalised wavefunction.

- (d) A quartz crystal of thickness 0.001 m is vibrating at resonance. Calculate the fundamental frequency
Given : young modulus for quartz is $7.9 \times 10^{10} \text{ Nm}^{-2}$ and density of quartz is $2.65 \times 10^3 \text{ kg/m}^3$.
- (e) Assuming that all the energy from a 1000 watt lamp is radiated uniformly. Calculate the average values of the intensities of electric and magnetic fields of radiation at a distance of 2 m from the lamp.

SECTION - C

Note : Attempt all questions. All questions carry equal marks. (5x5=25)

3. Attempt **any one** part of the following :

- (a) What is uncertainty principle ? Apply this to calculate the radius of the Bohr's first orbit.
- (b) What is physical significance of wavefunction ? Derive time independent schrodinger wave equation.

4. Attempt **any one** part of the following :

- (a) What is compton effect ? Derive an expression for the compton shift.
- (b) Derive claussius - Mossotti Equation in terms of relative permittivity.

5. Attempt **any one** part of the following :

- (a) What is hysteresis curve ? Explain residual magnetism, coercive force and hysteresis.
- (b) What are ultrasonics ? Discuss applications of ultrasonics.

6. Attempt **any one** part of the following :

- (a) Derive Maxwell's equations. Explain the physical significance of each equation.
- (b) Prove that the velocity of plane electromagnetic wave in the vacuum is given by

$$C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

Where various terms have their usual meaning.

7. Attempt **any one** part of the following :

- (a) Discuss characteristic properties and uses of superconductors.
- (b) How the carbon nanotubes are produced ? Discuss properties and uses of carbon nanotubes.

Physical constants :

Planck's constant $h = 6.62 \times 10^{-34} \text{ J.s}$

mass of neutron $m_n = 1.67 \times 10^{-27} \text{ kg}$

Permeability of free space $(\mu_0) = 4\pi \times 10^{-7} \text{ T.m/A}$

Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N.m}^2$

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